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HEWLETT-PACKARD COMPANY
Intellectual Property Administration
P.O. Box 272400
Fort Collins, Colorado 80527-2400

PATENT APPLICATION

ATTORNEY DOCKET NO. ___200314385-1___

IN THE
UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):   ZHANG, et al.

Confirmation No.: 3515

Application No.: 10/802,428

Examiner: Werner, D.

Filing Date: March 17, 2004

Group Art Unit: 2621

Title: ESTIMATING MOTION TRIALS IN VIDEO IMAGE SEQUENCES

Mail Stop Appeal Brief-Patents
Commissioner For Patents
PO Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL OF APPEAL BRIEF

Transmitted herewith is the Appeal Brief in this application with respect to the Notice of Appeal filed on ___August 29, 2008___ .

☒ The fee for filing this Appeal Brief is $540.00 (37 CFR 41.20).

☐ No Additional Fee Required.

(complete (a) or (b) as applicable)

The proceedings herein are for a patent application and the provisions of 37 CFR 1.136(a) apply.

☐(a) Applicant petitions for an extension of time under 37 CFR 1.136 (fees: 37 CFR 1.17(a)-(d)) for the total number of months checked below:

☐ 1st Month $130

☐ 2nd Month $490

☐ 3rd Month $1110

☐ 4th Month $1730

☐ The extension fee has already been filed in this application.

☒(b) Applicant believes that no extension of time is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time.

Please charge to Deposit Account 08-2025 the sum of ___$ 540___ . At any time during the pendency of this application, please charge any fees required or credit any over payment to Deposit Account 08-2025 pursuant to 37 CFR 1.25. Additionally please charge any fees to Deposit Account 08-2025 under 37 CFR 1.16 through 1.21 inclusive, and any other sections in Title 37 of the Code of Federal Regulations that may regulate fees.

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Typed Name:

Signature: _Kelly Davis_

Respectfully submitted,

ZHANG, et al.

By _____

LeRoy D. Maunu

Attorney/Agent for Applicant(s)

Reg No. :   35,274

Date :   October 28, 2008

Telephone :   651-686-633

Rev 10/08(AplBrief)

HEWLETT-PACKARD COMPANY
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NOV 0 3 2008

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Date of facsimile:
Typed Name: Kelly Davis
Signature: _Kelly Davis_

Respectfully submitted,

ZHANG, et al

By_____

LeRoy D. Maunu

Attorney/Agent for Applicant(s)

Reg No. : 35,274

Date : October 28, 2008

Telephone : 651-686-633

Rev 10/08(AplBrief)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appellants:	ZHANG et al.	Examiner:	Werner, D.
Serial No.:	10/802,428	Group Art Unit:	2621
Filed:	March 17, 2004	Docket No.:	200314385-1 (HPCO.145PA)
Title:	ESTIMATING MOTION TRIALS IN VIDEO IMAGE SEQUENCES		

Board of Patent Appeals and Interferences
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is an Appeal Brief submitted pursuant to 37 C.F.R. § 41.37 for the above-referenced patent application.

I. Real Party in Interest

The real party in interest is Hewlett-Packard Development Company, L.P., having a place of business Houston, Texas. The above referenced patent application is assigned to Hewlett-Packard Development Company, L.P.

II. Related Appeals and Interferences

Appellants are unaware of any related appeals, interferences or judicial proceedings.

III. Status of Claims

Claims 1-3, 5-15, 17-25, 27, and 29 are rejected and are presented for appeal. Claims 4, 16, 26, 28, and 30 have been cancelled and withdrawn from consideration. The appealed claims are in the attached Appendix of Appealed Claims.

IV. Status of Amendments

No amendment after final rejection was filed.

V. Summary of Claimed Subject Matter

In the embodiment set forth in claim 1, the invention is an article of manufacture, comprising a program storage device (p. 6, l. 5; p. 9, l. 8; Fig. 5, 588; p. 18, ll. 19-22) having stored thereon program instructions executable by a processing device to perform operations for estimating motion trials in video image sequences. The operations include providing data points representing information from an image sequence (p. 13, ll. 18-20; Fig. 9; p. 18, ll. 4-9) and performing regression clustering using a K-Harmonic Means function to cluster the data points and to provide motion information regarding the data points (p. 14, l. 16 – p. 15, l. 6). The performing regression clustering includes selecting a number of regression clusters, K, for data points from an image sequence (Fig. 8, 810; p. 17, l. 11-14). Regression functions are initialized for each of the K clusters to estimate the centers of motion for the data points (Fig. 8, 820; p. 17, ll. 15-17), and distances are calculated from each data point to each of the K regression functions (Fig. 8, 830; p. 17, ll. p. 17, ll. 16-17). The operations further include calculating a membership probability and a weighting factor for each data point based on distances between the K regression functions and each data point (Fig. 8, 840; p. 17, ll. 18-19; p. 16, ll. 11-14) and applying regression clustering using a K-Harmonic Means function to recalculate the K regression functions (Fig. 8, 850; p. 17, ll. 19-21; p. 14, l. 22 – p. 15, l. 6). A change in membership probability and a change in the K regression function are compared to a predetermined threshold (Fig. 8, 860; p. 17, ll. 22-23). The motion paths represented by the K regression functions are used when the

change in membership probability and change in the K regression function are less than a predetermined threshold (Fig. 10; p. 18, ll. 11-18; p. 16, ll. 8-10).

According to claim 13, a system (Fig. 6) for estimating motion trials in video image sequences is provided. An image sequence retrieval module (Fig. 6, 608) retrieves a current image and a first reference image and provides data points representing information from the current image and the first reference image (p. 11, ll. 6-10; p. 13, ll. 18-20; Fig. 9; p. 18, ll. 4-9; Fig. 2; p. 9, l. 20 – p. 10, l. 1). A motion estimator (Fig. 6, 610) is coupled to the image sequence retrieval module for performing regression clustering using a K-Harmonic Means function to cluster the data points and to provide motion information regarding the data points (p. 11, ll. 11-15). The motion estimator performs regression clustering by selecting a number of regression clusters, K, for data points from an image sequence (Fig. 8, 810; p. 17, l. 11-14) and initializing regression functions for each of the K clusters to estimate the centers of motion for the data points (Fig. 8, 820; p. 17, ll. 15-17). The motion estimator calculates the distances from each data point to each of the K regression functions (Fig. 8, 830; p. 17, ll. p. 17, ll. 16-17) and calculates a membership probability and a weighting factor for each data point based on distances between the K regression functions and each data point (Fig. 8, 840; p. 17, ll. 18-19; p. 16, ll. 11-14). The motion estimator applies regression clustering using a K-Harmonic Means function to recalculate the K regression functions (Fig. 8, 850; p. 17, ll. 19-21; p. 14, l. 22 – p. 15, l. 6) and compares a change in membership probability and a change in the K regression functions to a predetermined threshold (Fig. 8, 860; p. 17, ll. 22-23). The motion estimator uses motion paths represented by the K regression functions when the change in membership probability and change in the K regression function are less than a predetermined threshold (Fig. 10; p. 18, ll. 11-18; p. 16, ll. 8-10).

A method (Fig. 8, 800) for estimating motion trials in video image sequences is provided in claim 25. The method comprises providing data points representing information from an image sequence (p. 13, ll. 18-20; Fig. 9; p. 18, ll. 4-9) and performing regression clustering using a K-Harmonic Means function to cluster the data points and to provide motion information regarding the data points (p. 14, l. 16 –

3

p. 15, l. 6). The performing of regression clustering includes selecting a number of regression clusters, K, for data points from an image sequence (Fig. 8, 810; p. 17, l. 11-14) and initializing regression functions for each of the K clusters to estimate the centers of motion for the data points (Fig. 8, 820; p. 17, ll. 15-17). The performing of regression clustering calculates the distances from each data point to each of the K regression functions (Fig. 8, 830; p. 17, ll. p. 17, ll. 16-17) and calculates a membership probability and a weighting factor for each data point based on distances between the K regression functions and each data point (Fig. 8, 840; p. 17, ll. 18-19; p. 16, ll. 11-14). Regression clustering is applied using a K-Harmonic Means function to recalculate the K regression functions (Fig. 8, 850; p. 17, ll. 19-21; p. 14, l. 22 – p. 15, l. 6), and a change in membership probability and a change in the K regression functions are compared to a predetermined threshold (Fig. 8, 860; p. 17, ll. 22-23). The performing of regression clustering uses motion paths represented by the K regression functions when the change in membership probability and change in the K regression functions are less than a predetermined threshold (Fig. 10; p. 18, ll. 11-18; p. 16, ll. 8-10).

In claim 27, a system is provided for estimating motion trials in video image sequences. The system comprises means for retrieving a current image and a first reference image and providing data points representing information from the current image and the first reference image (Fig. 6, 608; Fig. 5, 500; p. 10, ll. 14-22; p. 11, ll. 6-10; p. 13, ll. 18-20; Fig. 9; p. 18, ll. 4-9; Fig. 2; p. 9, l. 20 – p. 10, l. 1). The system also includes means for performing regression clustering, coupled to the means for retrieving and providing. The means for performing regression clustering uses a K-Harmonic Means function to cluster the data points and to provide motion information regarding the data points (Fig. 6, 610; Fig. 5, 500; p. 10, ll. 14-22; p. 14, l. 16 – p. 15, l. 6). The means for performing regression clustering further comprises means for selecting a number of regression clusters, K, for data points from an image sequence (Fig. 8, 810; p. 17, l. 11-14), and means for initializing regression functions for each of the K clusters to estimate the centers of motion for the data points (Fig. 8, 820; p. 17, ll. 15-17). The means for performing regression clustering further includes means for calculating the distances from each data point to each of

4

the K regression functions (Fig. 8, 830; p. 17, ll. p. 17, ll. 16-17) and means for calculating a membership probability and a weighting factor for each data point based on distances between the K regression functions and each data point (Fig. 8, 840; p. 17, ll. 18-19; p. 16, ll. 11-14). The means for performing regression clustering further includes means for applying regression clustering using a K-Harmonic Means function to recalculate the K regression functions (Fig. 8, 850; p. 17, ll. 19-21; p. 14, l. 22 – p. 15, l. 6) and means for comparing a change in membership probability and a change in the K regression functions to a predetermined threshold (Fig. 8, 860; p. 17, ll. 22-23). Means are provided for using motion paths represented by the K regression functions when the change in membership probability and change in the K regression functions are less than a predetermined threshold (Fig. 10; p. 18, ll. 11-18; p. 16, ll. 8-10).

A system is provided in claim 29 for estimating motion trials in video image sequences. The system includes means for storing a current image and a first reference image (Fig. 5, 530; p. 11, ll. 1-4; Fig. 2; p. 9, l. 20 – p. 10, l. 1) and means, coupled to the means for storing, for retrieving and providing data points representing information from the current image and the first reference image (Fig. 6, 608; Fig. 5, 500; p. 10, ll. 14-22; p. 11, ll. 6-10; p. 13, ll. 18-20; Fig. 9; p. 18, ll. 4-9). The system further includes means, coupled to the means for retrieving, for performing regression clustering using a K-Harmonic Means function to cluster the data points and to provide motion information regarding the data points (Fig. 6, 610; Fig. 5, 500; p. 10, ll. 14-22; p. 14, l. 16 – p. 15, l. 6). The means for performing regression clustering includes means for selecting a number of regression clusters, K, for data points from an image sequence (Fig. 8, 810; p. 17, l. 11-14) and means for initializing regression functions for each of the K clusters to estimate the centers of motion for the data points (Fig. 8, 820; p. 17, ll. 15-17). The means for performing regression clustering further includes   means for calculating the distances from each data point to each of the K regression functions (Fig. 8, 830; p. 17, ll. p. 17, ll. 16-17), and means for calculating a membership probability and a weighting factor for each data point based on distances between the K regression functions and each data point (Fig. 8, 840; p. 17, ll. 18-19; p. 16, ll. 11-14). Means are provided for

5

applying regression clustering using a K-Harmonic Means function to recalculate the K regression functions (Fig. 8, 850; p. 17, ll. 19-21; p. 14, l. 22 – p. 15, l. 6), and means are provided for comparing a change in membership probability and a change in the K regression functions to a predetermined threshold (Fig. 8, 860; p. 17, ll. 22-23). The means for performing regression clustering further includes means for using motion paths represented by the K regression functions when the change in membership probability and change in the K regression functions are less than a predetermined threshold (Fig. 10; p. 18, ll. 11-18; p. 16, ll. 8-10).

VI. Grounds of Rejection

A. Claims 1-3, 5-7, and 10-12 stand rejected under 35 U.S.C. §101(b) as being directed to non-statutory subject matter.

B. Claims 1-3, 5-7, 10-15, 17-19, and 22-25 stand rejected under 35 U.S.C. §103(a) as being unpatentable over "De Smet" ("Motion-based segmentation using a thresholded merging strategy on watershed segments" by De Smet et al.) in view of "Zhang" ("K-Harmonic Means – A Data Clustering Algorithm" by Zhang et al.).

C. Claims 8-9 and 20-21 stand rejected under 35 USC §103(a) over the De Smet-Zhang combination, further in view of "Herrmann" ("A Video Segmentation Algorithm for Hierarchical Object Representations and its Implementation" by Herrmann et al.).

D. Claims 27 and 29 stand rejected under 35 USC §103(a) over the De Smet-Zhang combination in view of "Reitmeier" (U.S. Patent No. 6,084,912 to Reitmeier et al.).

VII. Argument

A. **The rejection of claims 1-12 should be reversed because the Examiner has not established a *prima facie* case that the claims are directed to non-statutory subject matter of 35 USC §101.**

Claim 1 recites an article of manufacture, comprising: a program storage device having stored thereon program instructions executable by a processing device to perform operations for estimating motion trials in video image sequences, the operations comprising ..." The Examiner asserted that claim 1 is directed to

non-statutory subject matter because "the specification, at paragraph 0088, defines the claimed computer-readable medium as encompassing statutory material such as a 'data storage', as well as non-statutory subject matter such as a 'carrier' or 'communications devices'." The Examiner explained that "a signal embodying functional descriptive material is neither a process nor a product (i.e., a tangible 'thing') and therefore, does not fall within one of the statutory classes of §101." For support, the Examiner cited *In re Petrus A.C.M. Nuijten* 500 F.3d 1346; 84 USPQ 2d 1495 (CAFC 2007, en banc denied), hereinafter "Nuijten."

The Examiner is incorrect because the plain claim language is contrary to the Examiner's interpretation, the Examiner misstated paragraph [0088] of the specification, and the cited case law is misapplied to the claims in question. The claim plainly recites a "program storage device" and not a "computer-readable medium" as the Examiner asserted. Those skilled in the art will recognize that a "storage device" is a physical structure and is not equivalent to a signal being a form of energy.

Paragraph [0088] reads in relevant part, "The process illustrated with reference to Figs. 1-10 may be tangibly embodied in a processor-readable medium or carrier, e.g. one or more of the fixed and/or removable data storage devices 588 illustrated in Fig. 5, or other data storage or data communications devices." Thus, Appellants do not "define" a computer-readable medium to be a carrier or a communications device. Rather the carrier is an alternative to the processor-readable medium. The fixed/removable data storage devices are examples of the processor-readable medium and the data communications devices are examples of the carrier. Since Appellants have not defined the claimed "program storage device" as being a non-tangible signal, the Examiner's reasons for rejecting the claim are improper.

Appellants further note that the Examiner misapplies the law evinced by Nuijten in rejecting claim 1. The only independent claim on appeal in Nuijten was claim 14, which read:

> A signal with embedded supplemental data, the signal being encoded in accordance with a given encoding process and selected samples of the signal representing the supplemental data, and at least one of the samples

preceding the selected samples is different from the sample corresponding to the given encoding process. (*Id.* at 1451)

This claim was held to not be patentable subject matter because "a transitory, propagating signal like Nuijten's is not a 'process, machine, manufacture, or composition of matter.'" (*Id.* at 1357). Appellants submit that their claim 1 recites "an article of manufacture" which comprises "a program storage device..." The reasons provided by the Court for finding Nuijten's claim to be non-statutory are clearly inapplicable to the present claim language since Nuijten's claim 14 clearly recited only a signal. Furthermore, Nuijten's claim 15, which was not subject to appeal, was "directed to '[a] storage medium having stored thereon a signal with embedded supplemental data'" and deemed allowable by the PTO (*Id.* at 1351). Appellants' claim 1 is similar in form to Nuijten's allowed claim 15. Therefore, the Examiner has not provided any legal basis for finding Appellants' claim 1 to be directed to non-statutory subject matter.

Claims 2-3, 5-7, and 10-12 have claim 1 as a base claim and are directed to statutory subject matter for at least the reasons set forth above. Appellants respectfully request that the rejection of claims 1-3, 5-7, and 10-12 be reversed.

B.   **The rejection of claims 1-3, 5-7, 10-15, 17-19, and 22-25 should be reversed because the Examiner has not established a *prima facie* case of obviousness of the claims under 35 U.S.C. §103(a) over the De Smet-Zhang combination.**

The Examiner failed to establish a *prima facie* case of obviousness of claims 1-3, 5-7, 10-15, 17-19, and 22-25 over the De Smet-Zhang combination because all the limitations are not shown to be suggested by the combination, and a proper motivation for modifying De Smet with teachings of Zhang has not been provided.

The De Smet-Zhang combination neither teaches nor suggests the limitations of "initializing regression functions for each of the K clusters to estimate the centers of motion for the data points; calculating the distances from each data point to each of the K regression functions; and calculating a membership probability and a

weighting factor for each data point based on distances between the K regression functions and each data point" as set forth in claim 1. Independent claims 13 and 25 include similar limitations.

De Smet teaches using a direct K-means (KM) cluster algorithm with a minimum distance merging technique (section 2.3). As described by Zhang, KM clustering is a center-based, iterative algorithm that refines the clusters defined by K centers. Likewise, Zhang's K-harmonic means (KHM) algorithm is also center based and refines the clusters defined by K centers (page 1, last paragraph). Zhang's KHM clustering algorithm starts with an initialization of center positions and iteratively refines these positions (page 2, second paragraph). Zhang's algorithm for the KHM performance function is said to be insensitive to this initialization of center positions (page 4, section 5). Zhang's "KHM algorithm starts with a set of initial positions of the centers ... and then the new positions of the centers are calculated ..." (page 5, third paragraph).

In contrast, the claimed invention uses "regression functions for each of the K clusters to estimate the centers of motion." As shown in FIG. 7 and described in paragraph [0049], "it is much better to find the partitions in the data and learn a separate function on each partition as shown in the graph of the three regression functions 750" as compared to the single regression function in graph 700. Thus, instead of using center positions, the present invention uses regression functions to estimate the centers of motion.

The current invention further calculates the distances from each data point to each of the K regression functions. Thus, the invention uses multiple K regression functions. In contrast, Zhang uses a single performance function, from which partial derivatives are taken with respect to the center positions (section 5, page 4). Also, since Zhang uses the distance from a data point to a center position (section 5, page 4), there is no apparent suggestion of the claimed calculated distances from each data point to each of the K regression functions.

The Examiner responded in the Office Action dated May 29, 2008 as follows:

However, the "each of the K regression functions" in the previous Office action was interpreted as the specific instance of KHM for each center point, since the present invention is directed to "using a K-Harmonic Means

9

function", which was read in the singular. Therefore, the calculation of a distance d between each data point and every center point is the claimed distance calculation according to the present invention.

Appellants respectfully submit that the Examiner's interpretation is contrary to the plain claim language and contrary to the supporting description found in the specification. The relevant claim limitations are as follows:

> ...
> performing regression clustering using a K-Harmonic Means function to cluster the data points and to provide motion information regarding the data points;
>> wherein the performing regression clustering includes:
>>> selecting a number of regression clusters, K, for data points from an image sequence;
>>> initializing regression functions for each of the K clusters to estimate the centers of motion for the data points;
>>> calculating the distances from each data point to each of the K regression functions;
> ...

The claim limitations set forth the general step of performing regression clustering using a K-Harmonic Means function to cluster the data points and to provide motion information, and that general step was made more specific by way of amending the claim to recite that the performing regression clustering includes initializing regression functions for each of the K clusters and calculating the distances from each data point to each of the K regression functions. Thus, the claimed initializing of the regression functions is part of the general step of performing regression clustering using a K-Harmonic Means function. Also, there are multiple regression functions, since multiple regression "clusters" were selected.

The claimed invention calculates the distances from each data point to each of the K regression functions, and the calculation of a distance between each data point and each center point as taught by Zhang is not equivalent to these limitations. Appellants submit that those skilled in the art would not recognize the prior art center points as being equivalent to the claimed regression functions, and the Examiner has not provided any evidence to support such equivalence. Furthermore, Appellants' specification provides an example in Fig. 7, 750 that shows multiple

regression functions from which distances of data points would be calculated (p. 12, ll. 8-11). Thus, the claim language clearly recites multiple regression functions, and those multiple regression functions are not equivalent to center points for purposes of determining the claimed distances.

Claims 2-7, 10-12, 14-19, and 22-24 depend from the independent claims discussed above. Thus, the Office Action has not shown that the De Smet-Zhang combination suggests the limitations of these dependent claims for at least the reasons set forth above.

The asserted motivation for combining the teachings of De Smet and Zhang is unsupported by evidence and improper. The Examiner asserted that "it would have been obvious ... to perform clustering based on a K-Harmonic means function, as taught by Zhang et al., rather than a linear function such as the K-means function of De Smet et al., since Zhang et al. states in the abstract that K-harmonic clustering is less sensitive to detrimental effects from sub-optimal initialization that [sic] conventional clustering techniques." The Examiner over-generalizes Zhang's teaching in regards to use of a K-Harmonic means algorithm to support the asserted motivation to combine Zhang's teachings with De Smet's teachings, and the Examiner has not presented any evidence that demonstrates clustering based on a K-harmonic means function, as taught by Zhang, is applicable to De Smet's block matching method.

The Examiner only partially cites Zhang's reason for using the K-Harmonic means algorithm in the asserted motivation for making the combination. Zhang states, "K-Harmonic Means algorithm (KHM) ... is a center-based clustering algorithm which uses the Harmonic Averages of the distances from each data point to the centers as components to its performance function [and] is essentially insensitive to the initialization of the centers." (Abstract). The Examiner generalized Zhang's teachings: "K-harmonic clustering is less sensitive to detrimental effects from sub-optimal initialization[,]" and ignored the fact that Zhang teaches that the KHM is insensitive to the initialization of the centers. There is no apparent evidence that De Smet teaches a center-based approach for obtaining a motion-based segmentation of an image sequence. Rather, De Smet teaches that "an initial

11

estimate for the motion field is obtained by using an improved block matching method." (Abstract). Nor is there any apparent evidence that ZHM as applied the center-based clustering is in any manner applicable to De Smet's improved block matching method for obtaining the initial estimate for the motion field. Since Zhang teaches that the KHM is insensitive to the initialization of the centers and De Smet's segmentation method does not use centers, the asserted motivation for combining Zhang with De Smet is unsupported by evidence and improper.

The rejection of claims 1-7, 10-12, 13-19, and 22-25 should be reversed because a *prima facie* case of obviousness has not been established.

C.   **The rejection of claims 8-9 and 20-21 over the De Smet-Zhang-Herrmann combination should be reversed because the Examiner has not established a *prima facie* case of obviousness.**

Claims 8 and 9 have claim 1 as a base claim, and claims 20-21 have claim 13 as a base claim. Herrmann's teachings do not remedy the deficiencies of the De Smet-Zhang combination as applied to the base claims and as explained above. Therefore, the Examiner has not shown that the De Smet-Zhang-Herrmann combination suggests all the limitations of claims 8-9 and 20-21, a *prima facie* case of obviousness has not been established, and the rejection should be reversed.

D.   **The rejection of claims 27 and 29 over the De Smet-Zhang-Reitmeier combination should be reversed because the Examiner has not established a *prima facie* case of obviousness.**

Claims 27 and 29 include limitations similar to those of claim 1. Reitmeier's teachings do not remedy the deficiencies of the De Smet-Zhang combination as applied to the limitations of claim 1 and as explained above. Therefore, the Examiner has not shown that the De Smet-Zhang-Reitmeier combination suggests all the limitations of claims 27 and 29, a *prima facie* case of obviousness has not been established, and the rejection should be reversed.

VIII. Conclusion

In view of the above, Appellant submits that the rejections are improper, the claimed invention is patentable, and that the rejections of claims 1-3, 5-15, 17-25, 27, and 29 should be reversed. Appellant respectfully requests reversal of the rejections as applied to the appealed claims and allowance of the entire application.

Respectfully submitted,

By: _____

Name: LeRoy D. Maunu
Reg. No.: 35,274

1. An article of manufacture, comprising:

a program storage device having stored thereon program instructions
executable by a processing device to perform operations for estimating motion trials
in video image sequences, the operations comprising:

providing data points representing information from an image
sequence; and

performing regression clustering using a K-Harmonic Means function
to cluster the data points and to provide motion information regarding the data
points;

wherein the performing regression clustering includes:

selecting a number of regression clusters, K, for data points
from an image sequence;

initializing regression functions for each of the K clusters to
estimate the centers of motion for the data points;

calculating the distances from each data point to each of the K
regression functions;

calculating a membership probability and a weighting factor for
each data point based on distances between the K regression
functions and each data point;

applying regression clustering using a K-Harmonic Means
function to recalculate the K regression functions;

comparing a change in membership probability and a change in
the K regression function to a predetermined threshold; and

using motion paths represented by the K regression functions
when the change in membership probability and change in the K
regression function are less than a predetermined threshold.

2.   The program storage device of claim 1, wherein the performing regression clustering using the K-Harmonic Means function to cluster the data points and to provide motion information regarding the data points further comprises providing motion vectors for the data points.

3.   The program storage device of claim 1, wherein the performing regression clustering using the K-Harmonic Means function to cluster the data points and to provide motion information regarding the data points further comprises providing at least one motion path for the data points.

5.   The program storage device of claim 1, wherein the initializing regression functions for each of the K clusters further comprises randomly initializing regression functions for each of the K clusters.

6.   The program storage device of claim 1, wherein the program instructions further include instructions for performing the operations comprising repeating the calculating the distances, the calculating membership probability and weighting factors, and applying regression clustering until the change in membership probability and change in the K regression function is not less than the predetermined threshold.

7.   The program storage device of claim 1, wherein the weighting factor is chosen to allow the K regression functions to be optimized with less sensitivity to initialization of the K regression functions.

8.   The program storage device of claim 1 further comprising extracting data according to a predetermined criteria to provide the data points.

9.   The program storage device of claim 8, wherein the extracting data according to the criteria comprises portioning data according to color.

10.   The program storage device of claim 1, wherein the program instructions further include instructions for performing the operations comprising preparing each of the data points as x-y-coordinate data points.

11.   The program storage device of claim 1, wherein the program instructions further include instructions for performing the operations comprising using the K regression functions to render the image sequence with motion paths shown on a display.

12.   The program storage device of claim 11, wherein the using the K regression functions to render the image sequence further comprises overlaying the K regression functions on the video images to show motion between the image sequences.

13.   A system for estimating motion trials in video image sequences, comprising:
       an image sequence retrieval module for retrieving a current image and a first reference image and providing data points representing information from the current image and the first reference image; and
       a motion estimator, coupled to the image sequence retrieval module, for performing regression clustering using a K-Harmonic Means function to cluster the data points and to provide motion information regarding the data points;
       wherein the motion estimator performs regression clustering by selecting a number of regression clusters, K, for data points from an image sequence, initializing regression functions for each of the K clusters to estimate the centers of motion for the data points, calculating the distances from each data point to each of the K regression functions, calculating a membership probability and a weighting factor for each data point based on distances between the K regression functions and each data point, applying regression clustering using a K-Harmonic Means function to recalculate the K regression functions, comparing a change in membership probability and a change in the K regression functions to a predetermined threshold and using motion paths represented by the K regression functions when the change

16

in membership probability and change in the K regression function are less than a predetermined threshold.

14.   The system of claim 13, wherein the motion information regarding the data points further comprises motion vectors for the data points.

15.   The system of claim 13, wherein the motion information regarding the data points further comprises at least one motion path for the data points.

17.   The system of claim 13, wherein the motion estimator randomly initializes regression functions for each of the K clusters.

18.   The system of claim 13, wherein the motion estimator repeats the calculation of the distances, the membership probability and weighting factors, and applies regression clustering until the change in membership probability and change in the K regression function is not less than the predetermined threshold.

19.   The system of claim 13, wherein the weighting factor is chosen to allow the K functions to be optimized with less sensitivity to initialization of the K regression functions.

20.   The system of claim 13, wherein the motion estimator extracts data according to predetermined criteria.

21.   The system of claim 20, wherein the motion estimator extracts data according to color.

22.   The system of claim 13, wherein the image sequence retrieval module prepares each of the data points as x-y-coordinate data points.

23.   The system of claim 13 further comprising a processor for using the K regression functions to render the image sequence with motion paths shown on a display.

24.   The system of claim 23, wherein the processor overlays the K regression functions on the video images to show motion between the current image and the first reference image.

25.   A method for estimating motion trials in video image sequences, the method comprising:

    providing data points representing information from an image sequence; and

    performing regression clustering using a K-Harmonic Means function to cluster the data points and to provide motion information regarding the data points

        wherein the performing regression clustering further comprises:

        selecting a number of regression clusters, K, for data points from an image sequence;

        initializing regression functions for each of the K clusters to estimate the centers of motion for the data points;

        calculating the distances from each data point to each of the K regression functions;

        calculating a membership probability and a weighting factor for each data point based on distances between the K regression functions and each data point;

        applying regression clustering using a K-Harmonic Means function to recalculate the K regression functions;

        comparing a change in membership probability and a change in the K regression functions to a predetermined threshold; and

        using motion paths represented by the K regression functions when the change in membership probability and change in the K regression functions are less than a predetermined threshold.

27. A system for estimating motion trials in video image sequences, comprising:

means for retrieving a current image and a first reference image and providing data points representing information from the current image and the first reference image; and

means for performing regression clustering, coupled to the means for retrieving and providing, wherein the means for performing regression clustering uses a K-Harmonic Means function to cluster the data points and to provide motion information regarding the data points

wherein the means for performing regression clustering further comprises means for selecting a number of regression clusters, K, for data points from an image sequence, means for initializing regression functions for each of the K clusters to estimate the centers of motion for the data points, means for calculating the distances from each data point to each of the K regression functions, means for calculating a membership probability and a weighting factor for each data point based on distances between the K regression functions and each data point, means for applying regression clustering using a K-Harmonic Means function to recalculate the K regression functions, means for comparing a change in membership probability and a change in the K regression functions to a predetermined threshold and means for using motion paths represented by the K regression functions when the change in membership probability and change in the K regression functions are less than a predetermined threshold.

29. A system for estimating motion trials in video image sequences, comprising:

means for storing a current image and a first reference image;

means, coupled to the means for storing, for retrieving and providing data points representing information from the current image and the first reference image; and

means, coupled to the means for retrieving, for performing regression clustering using a K-Harmonic Means function to cluster the data points and to provide motion information regarding the data points

wherein the means for performing regression clustering includes:

means for selecting a number of regression clusters, K, for data points from an image sequence

means for initializing regression functions for each of the K clusters to estimate the centers of motion for the data points,

means for calculating the distances from each data point to each of the K regression functions,

means for calculating a membership probability and a weighting factor for each data point based on distances between the K regression functions and each data point,

means for applying regression clustering using a K-Harmonic Means function to recalculate the K regression functions,

means for comparing a change in membership probability and a change in the K regression functions to a predetermined threshold; and

means for using motion paths represented by the K regression functions when the change in membership probability and change in the K regression functions are less than a predetermined threshold.

APPENDIX OF EVIDENCE FOR
APPLICATION NO. 10/802,428

Appellant is unaware of any evidence submitted in this application pursuant to 37 C.F.R. §§ 1.130, 1.131, and 1.132.

APPENDIX OF RELATED PROCEEDINGS FOR
APPLICATION NO. 10/802,428

Appellant is unaware of any related appeals, interferences or judicial proceedings.